THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

ANRITSU COMPANY MORGAN HILL CALIBRATION SERVICES

Morgan Hill, CA

for technical competence in the field of **Calibration**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 5th day of June 2008.

President
For the Accreditation Council
Certificate Number 2160.01
Valid to April 30, 2010

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.

SCOPE OF ACCREDITATION TO ISO 17025:2005
& ANSI/NCSL Z540-1-1994

ANRITSU COMPANY MORGAN HILL CALIBRATION SERVICES
490 Jarvis Drive
Morgan Hill, CA 95037
Yeou-Song (Brian) Lee Phone: 408 201 1976

CALIBRATION

Valid To: April 30, 2010 Certificate Number: 2160.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Electrical – RF/Microwave

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
S Parameters – Magnitude and Phase for S11, S12, S21, S22[3]			
Airline:			VNA:
S11/S22	10 MHz to 40 GHz	*M*/0.025 (lin); *P*/5	37XXX and 360 with
S12/S21		*M*/0.28 dB; *P*/20	calibration/verification kits
			3663/3653, 3666/3650-1,
Beatty Airline:			3667/3651-1, 3668/3652-1
S11/S22		*M*/0.08 (lin); *P*/5	
S12/S21		*M*/0.28 dB; *P*/50	
20 dB Attenuation:			
S11/S22		*M*/0.025 (lin); *P*/5	VNA:
S12/S21		*M*/0.28 dB; *P*/5	MS 462X with
			calibration/verification kits
40/50 dB			3663R/3753R,
Attenuation:			3666R/3750R,
S11/S22	> 10 MHz to 40 GHz	*M*/0.025 (lin); *P*/5	3667R/3751R
S12/S21		*M*/0.26 dB; *P*/5	
			M represents magnitude *P*
S12/S21	10 MHz	*M*/0.54 dB	represents phase

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
50 Ω Airline Characteristic Impedance	50Ω: (2 to 18) GHz (18 to 40) GHz	 1.0 mΩ/Ω 2.0 mΩ/Ω	Airlines: 18A50, 18N50, 18NF50, 19K50, 19KF50
VSWR	40 MHz to 40 GHz	2.5 dB	Scalar network analyzers (54169A, 18X50, 19X50, SM/PL, 26X50-X, 28X50-X, 29X50-X, 97X50-X, 560-97X50-X, 560-98X50); vector network analyzers, passive microwave components
Power Sensors – Type N Connector Type K Connector	100 kHz to 40 GHz Calibration Factor: At 50 MHz At 100 kHz to 18 GHz At 50 MHz At 100 kHz to 40 GHz	 0.56 % reading 0.92 % reading 1.4 % reading 3.6 % reading	Power Sensors: MA2400X 100 kHz to 18 GHz MA2400X 100 kHz to 40 GHz
Power Level – Type N and K-Type Connector (20 to -110) dBm 30 MHz to 40 GHz 0 dBm (20 to -60) dBm (except 0 dBm)	 30 MHz (50 to 150) MHz (0.15 to 2) GHz (2 to 12) GHz (13 to 18) GHz (19 to 32) GHz (33 to 40) GHz 30 MHz (50 to 150) MHz (0.15 to 2) GHz (2 to 12) GHz (13 to 18) GHz (19 to 32) GHz (33 to 40) GHz	 0.87 dB 0.22 dB 0.17 dB 0.27 dB 0.3 dB 0.4 dB 0.54 dB 0.88 dB 0.24 dB 0.19 dB 0.28 dB 0.32 dB 0.42 dB 0.56 dB	 Direct power measurement (for type N and K-type connector), MA 247XA/B with ML 2437/8A Note: mismatch included in best uncertainty.

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Power Level – Type N and K-Type Connector 20 dBm to -110 dBm (30 MHz to 40 GHz)			
(-60 to -85) dBm	30 MHz (50 to 150) MHz (0.15 to 2) GHz (2 to 12) GHz (13 to 18) GHz (19 to 32) GHz (33 to 40) GHz	0.92 dB 0.34 dB 0.3 dB 0.37 dB 0.4 dB 0.49 dB 0.62 dB	Direct power measurement, MA 247XA/B with ML 2437/8A Note: mismatch included in best uncertainty.
(-85 to -95) dBm	30 MHz (50 to 150) MHz (0.15 to 2) GHz (2 to 12) GHz (13 to 18) GHz (19 to 32) GHz (33 to 40) GHz	0.93 dB 0.35 dB 0.32 dB 0.39 dB 0.41 dB 0.5 dB 0.63 dB	
(-95 to -100) dBm	30 MHz (50 to 150) MHz (0.15 to 2) GHz (2 to 12) GHz (13 to 18) GHz (19 to 32) GHz (33 to 40) GHz	1.3 dB 0.92 dB 0.91 dB 0.94 dB 0.95 dB 1 dB 1.1 dB	
Frequency Modulation – Measure			
Rate: 20 Hz to 10 kHz, ≤40 kHz peak	(0.25 to 10) MHz	2.3 % reading + 1 digit	8902 Measuring receiver
Rate: 50 Hz to 100 kHz, ≤400 kHz peak	(0.25 to 10) MHz	1.2 % reading + 1 digit	
Rate: 20 Hz to 200 kHz, ≤400 kHz peak	(10 to 1300) MHz	5.8 % reading + 1 digit	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Amplitude Modulation – Measure			
Rate: 50 Hz to 10 kHz, 5% to 99%	(0.15 to 10) MHz	2.3 % reading + 1 digit	8902 measuring receiver
Rate: 20 Hz to 10 kHz, to 99%		3.5 % reading + 1 digit	
Rate: 50 Hz to 50 kHz, 5% to 99%	(10 to 1300) MHz	1.2 % reading + 1 digit	
Rate: 20 Hz to 100 kHz, to 99%		3.5 % reading + 1 digit	
Attenuation –			VNA:
Coaxial Type K (2.92 mm)	(0 to 40) dB; (0.05 to 2.0 GHz)	0.04 dB	Note: mismatch not a factor in best uncertainty
	(0 to 40) dB; (2.0 to 20.0 GHz)	0.18 dB	
	(0 to 40) dB; (20.0 to 40.0 GHz)	0.21 dB	
	(40 to 60) dB; (0.05 to 2.0 GHz)	0.40 dB	
	(40 to 60) dB; (2.0 to 20.0 GHz)	0.41 dB	
	(40 to 60) dB; (20.0 to 40.0 GHz)	0.20 dB	
Coaxial Type-N (10 to 1300) MHz	0 dB 10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB 100 dB 110 dB	0.026 dB + *M* 0.026 dB + *M* 0.034 dB + *M* 0.045 dB + *M* 0.055 dB + *M* 0.065 dB + *M* 0.074 dB + *M* 0.088 dB + *M* 0.096 dB + *M* 0.098 dB + *M* 0.11 dB + *M* 0.15 dB + *M*	*M* = Mismatch

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Attenuation – (cont)			Measuring receiver
(1300 to 2000) MHz	0 dB 10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB 100 dB 110 dB	0.035 dB + *M* 0.035 dB + *M* 0.053 dB + *M* 0.074 dB + *M* 0.096 dB + *M* 0.13 dB + *M* 0.15 dB + *M* 0.17 dB + *M* 0.19 dB + *M* 0.23 dB + *M* 0.25 dB + *M* 0.27 dB + *M*	*M* = Mismatch

II. Time & Frequency

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Frequency – GPS Disciplined Oscillator, Fixed Point	10 MHz	1 part in 10^{12}	Aging rate
Frequency Accuracy – Measure	10 MHz to 40 GHz	1.2 Hz	Frequency counter

[1] This laboratory offers commercial and on-site calibration services.

[2] "Best Uncertainty" is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] On-site calibration service is available for this calibration. The uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.